

Claims

What is claimed is:

- 1 1. A sample injection system comprising:
2 a work surface for supporting a plurality of liquid sample
3 containers;
4 a probe having a vertical axis;
5 a probe drive system including an X arm extending horizontally in
6 an X direction, a Y arm slideably mounted on said X arm and extending
7 horizontally in a Y direction, a Z arm slideably mounted on said Y arm
8 and extending vertically in Z direction, and a probe holder holding said
9 probe and slideably mounted on said Z arm;
10 a probe pump providing positive and negative pressure for said
11 probe for sample dispensing and aspiration;
12 a sample analyzer;
13 a source of pressurized liquid phase;
14 an injector valve connected to said probe, to said probe pump, to
15 said source of pressurized liquid phase and to said sample analyzer;
16 a conduit connecting said probe to said injector valve; and
17 said injector valve being mounted on said probe drive system.
- 1 2. A sample injection system as claimed in claim 1, said
2 sample analyzer including a liquid chromatography column.
- 1 3. A sample injection system as claimed in claim 1, said source
2 of pressurized liquid phase including a high pressure pump.
- 1 4. A sample injection system as claimed in claim 1, said probe
2 pump comprising a syringe pump.
- 1 5. A sample injection system as claimed in claim 1, said probe
2 drive system including X, Y and Z drive motors for moving said Y arm, Z
3 arm and probe holder respectively.

1 6. A sample injection system as claimed in claim 1, said
2 conduit being directly and continuously connected between said probe
3 and said injector valve.

1 7. A sample injection system as claimed in claim 6, said
2 conduit having a length less than twelve inches.

1 8. A sample injection system as claimed in claim 7, said
2 injector valve being mounted on said Z arm.

1 9. A sample injection system as claimed in claim 8, said
2 injector valve being located within about six inches of said vertical axis
3 of said probe.

1 10. A sample injection system as claimed in claim 1, said
2 injector valve being located within about six inches of said vertical axis
3 of said probe.

1 11. A sample injection system as claimed in claim 10, said
2 injector valve being mounted on said Z arm.

1 12. A sample injection system as claimed in claim 11, said
2 conduit being directly and continuously connected between said probe
3 and said injector valve.

1 13. A sample injection system as claimed in claim 12, said
2 conduit having a length less than twelve inches.

1 14. A liquid chromatography sample injection system for use
2 with an automated liquid handler of the type having a probe and a probe
3 drive system for moving the probe relative to sample containers, said
4 sample injection system comprising an injector valve mounted upon the
5 probe drive system, and a conduit directly connecting the probe to said
6 injector valve.

1 15. A sample injection system for inserting liquid samples into a
2 liquid phase flow for analysis, said sample injection system comprising:
3 a support for containers holding samples;
4 an injector valve having a sample loop, a probe port, a mobile
5 phase input port, a column output port and a probe pump port;
6 a probe connected to said probe port;
7 a sample analyzer connected to said column output port;
8 a probe pump connected to said probe pump port;
9 a source of pressurized mobile phase connected to said mobile
10 phase input port;
11 a drive system for moving said probe horizontally into vertical
12 alignment with any selected one of said containers and for moving said
13 probe vertically into said selected one of said containers;
14 said injector valve being movable to a load position defining a
15 sample loading flow path from said probe port and through said sample
16 loop to said probe pump port whereby said sample loop is filled with
17 sample from said probe;
18 said injector valve being movable to an inject position defining a
19 sample injection flow path from said mobile phase input port and through
20 said sample loop to said column output port whereby said sample in said
21 sample loop is captured in the mobile phase and flows to said sample
22 analyzer; and
23 a flow conduit directly connecting said probe to said probe port.

1 16. A sample injection system as claimed in claim 15, said
2 injector valve being mounted on said drive system.

1 17. A sample injection system as claimed in claim 16, said
2 source of pressurized liquid phase including a high pressure pump, and
3 said sample analyzer including a liquid chromatography column.

1 18. A sample injection system as claimed in claim 17, said
2 injector valve in said loading position defining a flow path between said
3 high pressure pump and said liquid chromatography column, and said
4 injector valve in said inject position defining a flow path between said
5 probe pump and said probe.